Investment and Determinants of Financial Constraints When Sample Splitting Criteria Are Unknown and Endogenous*

Bersant HOBDARI**
and
Derek C. JONES
and
Niels MYGIND

March 02, 2007

Abstract:
Unlike previous empirical work in analyzing investment behavior and the determinants of liquidity constraints, we use a switching regression framework when sample separation is unknown and endogenous and firms are assumed to operate either in the financially constrained or in the financially unconstrained regime. The actual regime the firm is in is determined by a switching or selection function, which depends on those variables that theoretically determine the wedge between internal and external finance, the severity of information and agency problems and time-varying firm characteristics. By using new panel data for Estonian companies during 1993 through 1999 we find that: (i) separate regimes exist in investment behavior; (ii) the likelihood of being financially constrained is higher in firms that are recently privatized, small and where ownership is concentrated in the hands of insiders and the state; (iii) soft budget constraints lower the probability of a firm being financially constrained; (iv) the actual probabilities of operating in the financially constrained regime are calculated to be quite high and essentially stable during 1993-1999: 0.52-0.57 for state owned firms, 0.40-0.46 for domestic owned firms and 0.53-0.57 for employee owned firms; (v) ownership structure affects investment beyond its indirect effects through financial constraints.

Keywords: Corporate Investment, Liquidity Constraints, Insider Ownership, Switching Regression, Soft Budget Constraint.
JEL Classification: C33, D21, D92, E22, G32, J54, P21.

*The paper has benefitted from comments from Jeffrey Pliskin and from participants when presented at seminars at the 4th International Workshop on Transition and Enterprise Restructuring in Eastern Europe at CopenhagenBusiness School, Department of Economics at Simon Fraser University and the 12th IAFEP Conference in Halifax.

**Hobdari, the corresponding author is at the Department of International Economics and Management, Copenhagen Business School, Porcelanhaven 24, 2000 Frederiksberg, Denmark e-mail : bh.cees@cbs.dk. Jones is at the Department of Economics, Hamilton College, Clinton, NY 13323, USA : e-mail : djones@hamilton.edu. Mygind is at the Department of International Economics and Management, Copenhagen Business School, Porcelanhaven 24, 2000 Frederiksberg, Denmark : e-mail : nm.cees@cbs.dk

Investment and Determinants of Financial Constraints When Sample Splitting Criteria Are Unknown and Endogenous*

Abstract:

Unlike previous empirical work in analyzing investment behavior and the determinants of liquidity constraints, we use a switching regression framework when sample separation is unknown and endogenous and firms are assumed to operate either in the financially constrained or in the financially unconstrained regime. The actual regime the firm is in is determined by a switching or selection function, which depends on those variables that theoretically determine the wedge between internal and external finance, the severity of information and agency problems and time-varying firm characteristics. By using new panel data for Estonian companies during 1993 through 1999 we find that: (i) separate regimes exist in investment behavior; (ii) the likelihood of being financially constrained is higher in firms that are recently privatized, small and where ownership is concentrated in the hands of insiders and the state; (iii) soft budget constraints lower the probability of a firm being financially constrained; (iv) the actual probabilities of operating in the financially constrained regime are calculated to be quite high and essentially stable during 1993-1999: 0.52-0.57 for state owned firms, 0.40-0.46 for domestic owned firms and 0.53-0.57 for employee owned firms; (v) ownership structure affects investment beyond its indirect effects through financial constraints.

Keywords: Corporate Investment, Liquidity Constraints, Insider Ownership, Switching Regression, Soft Budget Constraint.

JEL Classification: C33, D21, D92, E22, G32, J54, P21.

1. Introduction

It has long been accepted that access to capital is an important determinant of rates of investment. While an empirical literature has begun to emerge that investigates issues surrounding liquidity constraints in firms' investment decisions, our main motivation for the paper is that the dominant strategies used in the empirical investment literature suffer from several shortcomings. By using new panel data for Estonian firms during the period 1993 to 1999, we respond to some of these deficiencies. More specifically, we employ improved sample splitting criteria for separating firms into financially constrained and unconstrained. In addition we ensure that the implementation of these improved sample splitting criteria are integrated with appropriate theoretical modeling of investment, as well as the adoption of pertinent empirical strategies. We test whether or not separate regimes exist for firms that are financially constrained or unconstrained and we also compare the investment-cash flow sensitivities for firms in these regimes. The use of panel data allows us to tackle problems such as selectivity and aggregation bias, and measurement error.

This paper is of particular interest in that we provide evidence on the impact of the severity of information asymmetries and agency costs and the existence of soft budget constraints on the likelihood of firms' being financially constrained. Moreover, by calculating probabilities of firms' operating in the financially constrained regime we are able to provide evidence of the pervasiveness of financial constraints across groups of firms and their persistence over time in an advanced transition economy such as Estonia. Furthermore, we provide evidence on differences in propensity to invest by ownership structure as well as broad support to the hypothesis whether firms in transition economies behave similarly to those in advanced market economies.

The point of departure for standard empirical approaches is the recognition both of the importance of liquidity constraints in firms' investment decisions and also that the effect

of liquidity constraints is not evenly distributed across firms with some firms facing higher costs when raising capital than do others. These arguments lead to a financing hierarchy or pecking order hypothesis, whereby, when undertaking investments, financially constrained firms first prefer internal financing to more expensive external financing and then, if external financing is needed, prefer low-risk debt financing to new equity issues. In testing these hypotheses empirical research usually follows a strategy in which, initially, a standard investment demand model (e.g., accelerator or neoclassical or Tobin's Q) is augmented with financial variables to proxy for the degree of financial constraints. Alternatively, structural investment equations are derived from optimization of the firm's objective function under debt and equity constraints, and the sample is divided, a priori, into financially constrained and unconstrained firms using alternative classification criteria. Finally, separate equations are estimated for each group of firms. Support for the financing hierarchy hypothesis is provided if financial variables present in investment equations are found to be significant for financially constrained firms, but insignificant for financially unconstrained firms.

Yet this empirical strategy has its problems[1]. In this paper we address the biases that arise in testing for the presence of financial constraints, independently of how investment decisions are modeled, when the sample splitting criteria that are used may be inappropriate. In most of the empirical literature a single quantitative or qualitative indicator, such as dividend payout ratios, bond rating, degree of bank affiliation, firm size, firm age, or ownership structure, is used to partition firms into those that are or are not potentially financially constrained[2]. The implication of these approaches is that the estimation results would be highly sensitive to the criteria and threshold values chosen. The conflicting findings in the existing literature, reviewed for example in Schianterelli (1996), provide ample support for this implication.

Another and perhaps a more important consideration is that, independently of the number of indicators used in partitioning the sample or in choosing the threshold values, a firm is exogenously classified as financially constrained or not. In addition, firms are kept in that regime over the whole sample period**.** In general, the partition indicator will be correlated with the dependent variable, which causes endogenous selection problems. The *ad hoc* selection of partition criteria is, therefore, likely to cause what might be called static misclassification. Furthermore, as financial constraints change, over time firms might move from one regime to the other. Thus even if the classification method avoids problems of static misclassification, over time the issue of what might be called dynamic misclassification arises. This issue becomes more important as the time period under consideration lengthens. In the paper, both the static and dynamic misclassification problems are tackled by introducing a switching regression approach with endogenous and unknown sample separation.

In the next section we discuss our data and the definitions of variables employed in the analysis. This is followed by an account of the estimating approach and the specifications we use in the empirical analysis. In the fourth section, estimation results are reported and discussed. While in the last part we conclude and discuss some implications of our findings.

2. Sample Description and Variable Definitions

The degree and pervasiveness of liquidity constraints depend on the stage of development of the financial system. Estonia needed not only to liberalize its existing centralized financial system, but also to build new institutions and develop the regulatory and supervisory framework. Financial liberalization, which happened early on in transition, included the abolishment of subsidies and direct credits, as well as of controls on interest rates and on capital movements. Institution building started with the establishment of Estonian Central Bank in 1990[3] and the adoption of a two-tier banking system. The EBRD (1994)

reports that this led to the creation, between 1989 and 1992, of 42 commercial banks, mostly small, undercapitalized and owned by large enterprises. A serious banking crisis during 1992-1993 caused industry consolidation and market concentration through a wave of mergers and liquidations. By 1997, the share of bank assets owned by the state had fallen to zero, as documented in Table 1[4].

A further feature of the Estonian banking sector is increased foreign presence, both the proportion of the total number of banks that are foreign owned and the share of total bank assets owned by foreigners, which rose from 15% in 1994 to 61% in 1998 (Mygind, 2000). In addition to consolidation, the banking crisis also led to increased regulation and tighter supervision in order to improve the efficiency of the banking system. Overall, Estonia scores quite high in the index of banking system reforms, with only Hungary scoring higher. Yet, as Berglof and Bolton (2002) argue, often banks in transition economies are more involved in financing the government rather than the private system. However, because of the currency board introduced in 1992 and the balanced state budget Estonia is not an exception in this respect, although the share of credit to the private sector[5] has steadily increased over time reaching almost 26% of GDP in 2000. In sum, the banking system in Estonia is consolidated, well regulated, increasingly foreign-owned, increasingly active in financing private activity, and relatively efficient, as expressed by the percentage of bad loans to total loans.

Another potential source of both debt and equity capital for the private sector is the capital market. However, it was not until the end of 1994 that shares started to be traded over-the-counter at a computerized depository. The Tallin Stock Exchange (TSE) did not start operating until May 1996, using a continuous trading, market-making system. The initial market capitalization was 16.7% of GDP. By 2000, only 23 companies were listed on the TSE with total market capitalization amounting to 35% of GDP[6]. The stock market[7], however, is small and not sectorally diversified. Attempts have also been made to integrate the Estonian

market with other capital markets in the region by building exchange alliances. In January 2000, the stock exchanges for all three Baltic Republics started trading a pan-Baltic list of shares that included 5 Estonian firms.

In summary, the development of the financial system infrastructure in Estonia made it increasingly possible for companies to gain access to capital through bank loans, while the stock market played only a marginal role as a source of capital. However, as enterprises engaged in deeper post-privatization restructuring, higher demand for funds, accompanied by limited bank involvement in financing the private sector, resulted in heavier reliance on internal finance and severe credit rationing for specific groups of firms[8].

This conjecture is tested using annual firm-level observations of a sample of Estonian firms over the period 1993 through 1999. The sample is created through a combination of data obtained from surveys and from standard firm financial statements reported to the Estonian Statistical Office. The surveys gather information on ownership configurations, which is not available in standard financial statements. The firms included in the survey scheme are selected as a stratified random sample based on size and industry. However, before merging this information to create an unbalanced panel data set for the data analysis, we recognize that, potentially, there are issues of measurement error in financial data during early transition that other researchers have noted (e.g. Filer and Hanousek, 2002). To address these issues, we use several criteria to examine our data.[9] The application of all these criteria results in our using in the data analysis a data set consisting of 3294 observations over the whole period 1993 through 1999.[10] The detailed list of variables and their definitions are given in Table 2.

Sample firms are classified into six ownership groups according to the dominant owner: domestic outsider, employee, former employee, foreign, manager and state. The data[11] show that insider ownership, i.e., employee and manager, emerged as an important form of privatization. For example, in 1995 in more than 22% of cases, insiders or former insiders are

dominant owners. Foreign owned companies comprise around 12% of the sample, with most of them being new companies established in the early 1990s, while domestic outsider owned firms comprise around 18% of cases. Finally, state owned firms account for around 48% of the sample, with 232 firms being 100% state owned while 30 firms are mostly in private hands but with the state still holding a dominant position[12]. Inspecting the size distribution of firms reveals that state owned firms are mostly large. By contrast, insider owned (i.e., employee, former employee and manager owned) and, surprisingly, foreign owned firms tend to be of small and medium size. Domestic outsider owned firms are both small and large.

Table 3.1 presents summary statistics of the most relevant variables used in the analysis for the whole (unbalanced) panel, while Table 3.2 presents summary statistics for the balanced panel[13]. One observation emerging from both of these tables is that investment levels are high relative to capital stock, with investment/capital ratio ranging from 0.17 in 1993 to 0.34 in 1995 for the unbalanced panels and from 0.17 in 1993 to 0.36 in 1995 for the balanced panel. We also see that average employment decreases while real wage increases over time, that cash flow is positive, that short-term debt increases over time and that cash flow and short-term debt are approximately the same magnitude in most years. The increase in debt after 1995 is consistent with the general increase of lending to the private sector during this period as reported in Table 1. This serves as an indication that Estonian firms enjoy access to capital and might not be as liquidity constrained as one could expect at this early stage of transition. Furthermore, up to 1997, the sum of cash flow and short-term debt is less than investment suggesting that firms might have had access to other sources of capital such as short-term trade credit and/or long-term debt. This conjecture is supported by the last two rows of the table that show current payables and long-term liabilities, which include long-term loans as well as any other long-term debt a firm accumulates. The rate of growth of long-term liabilities is not high, except for the last year in the unbalanced panel, suggesting that

long-term liabilities do not constitute an important source of capital over the stated period. Current payables, however, are quite high and higher than investment over the whole period, suggesting that they have been an important source of financing especially during the early years of the transition. Another important feature of Estonian firms during this period is that, on average, they have become more capital intensive as demonstrated by the increase in capital and the decrease in employment.

Finally, to ascertain the importance of internal versus external financing in investment in fixed capital, we focus on the share of investment financed through internal funds or short or long-term debt. Information on the sources of financing investment is available for a small sub-sample of firms.[14] Tables 4.1 and 4.2 show the evolution of the share of investment financed through internal funds and loans by ownership group.[15] It is apparent that, for all ownership groups, a very high share of investment is financed through internal funds. In several cases, notably for employee owned, former employee owned and state owned firms, in some years this share is as high as 100%. In no case is this share below 60%, which is in sharp contrast with the findings of Estrin and Jones (1998) who find that employee owned firms in their French sample fund up to 47% of their investment externally. Foreign owned firms receive most outside financing[16], with the highest share reaching 37% in 1994, followed by domestic outsider owned firms. This reliance on internal financing might result from owners' reluctance to use external financing due to fear of loss of control or it might reflect an inability to borrow externally[17].

The data used in this study often possess certain advantages compared to data used by most other researchers, especially those working on transition. First, our surveys allow us to define a broader range of ownership groups than are usually found in transition studies where, if ownership data are available, classifications are usually restricted to state, foreign and domestic private firms. When authors are able to identify insider owners, they can seldom

distinguish between employees, managers or former insiders. Second, the use of different waves of ownership data allows us to capture dynamics that are not possible to capture when shorter data series are used[18]. Finally, the combination of ownership with economic and financial data allows us to better measure the effect of unobserved firm characteristics, such as, for instance, the existence and degree of soft budget constraints, on firm behavior. These features of our data may make our findings of interest to both researchers on transition as well, more generally, to students of corporate governance.

3. The Estimating Framework

A switching regression model[19] is based on the existence of a switching function that determines whether a firm operates in one of several potential regimes. The appropriateness of using this model is determined by the model's ability to identify significant differences in the data at hand that allow efficient clustering of firms into groups. A further advantage of the model is that it allows for the simultaneous determination of differences in investment behavior across firms and the likelihood of their belonging to a particular regime over time.

At any time, a firm is assumed to operate either in the financially unconstrained (FU) or in the financially constrained (FC) regime. While the number of regimes is known, the particular regime a firm operates in is determined by the switching function, which depends on those variables that theoretically determine the wedge between internal and external finance, severity of information and agency problems and time-varying firm characteristics. Assume that for every firm, operating in one of the financial regimes mentioned above, at any time, investment equations are given by the following expressions:

$$\left(\frac{I_t}{K_{t-1}}\right)^{FC} = X_{i,t} \cdot \beta_1 + \varepsilon_{1i,t} \qquad (1)$$

$$\text{if} \qquad Z_{i,t} \cdot \alpha + \varepsilon_{i,t} \geq 0 \qquad (2)$$

$$\left(\frac{I_t}{K_{t-1}}\right)^{FU} = X_{i,t} \cdot \beta_2 + \varepsilon_{2i,t} \tag{3}$$

$$\text{if} \qquad Z_{i,t} \cdot \alpha + \varepsilon_{i,t} < 0 \tag{4}$$

In the above equations i denotes firms, t denotes time, $X_{i,t}$ and $Z_{i,t}$ are vectors of explanatory variables that might possibly overlap, β_1, β_2 and α are vectors of parameters to be estimated, while $\varepsilon_{1i,t}$, $\varepsilon_{2i,t}$ and $\varepsilon_{i,t}$ are respective error terms that are supposed to be correlated across equations, but not over time. Equations (1) and (3) are the structural investment equations, while equations (2) and (4) constitute the switching function that, together with the investment equations, will be estimated simultaneously.

A further assumption that needs to be made to close the model is whether the sample separation is known or not, i.e., whether the observed values of investment are known beforehand to come from the process given by equation (1) or from the process given by equation (3). Here it is assumed that this is not known and the model specified then becomes an endogenous switching regression model with sample separation unknown[20]. The parameters of the investment equations and the switching function are then estimated by maximum likelihood techniques.[21] Once the equations are estimated, the respective probabilities of the firm being in either regime are calculated.

In estimating the above model, functional forms for both the investment and switching equations need to be specified. Here we assume that the investment equation corresponds to the one derived from neoclassical/accelerator models of investment demand as, for example, in Koyck (1954) and Jorgenson (1963). Although these models are derived under restrictive assumptions, they perform well empirically and are among the most widely used in both the western and transition literature[22]. In its basic form the neoclassical/accelerator model is derived under the assumption that the supply of investment funds is perfectly elastic and, consequently does not allow financial constraints to affect investment. Usually, in the

literature, profit or cash flow variables are included in empirical specifications to account for the possibility of imperfect substitutability of internal and external finance. However, it is not clear whether the coefficients of these variables reflect more imperfect substitutability of internal and external finance, information on future profitability of the firm or the presence of Jensen's (1986) "free cash flow". One way to partially overcome this problem is to introduce interaction terms between cash flow and variables designed to measure the severity of agency costs. The difference in estimates of the coefficients of these variables will then be interpreted as differences in access to external finance. Alternatively, under the assumption that a non-zero cash flow coefficient for unconstrained firms captures future profitability, the difference in size between cash flow coefficients of constrained and unconstrained firms can be interpreted as capturing the reliance on internal finance. Following this discussion, the investment equation to be estimated is:

$$\left(\frac{I_t}{K_{t-1}}\right) = \alpha + \sum_{s=1}^{S} \beta_s \cdot \frac{Y_{i,t-s}}{K_{i,t-1}} + \sum_{s=1}^{S} \gamma_s \cdot \frac{CF_{i,t-s}}{K_{i,t-1}} + \lambda \cdot D_{i,t} + \xi \cdot M_{i,t} + \varepsilon_{i,t} \qquad (5)$$

where I, K, Y and CF denote investment, capital, output (sales) and cash flow respectively, s stands for the number of lags to be included, D is a vector of industry and time dummies that capture effects common to all firms, while M is the inverse Mill's ratio or the probability that the firm is included in the sample. The latter is included because, for some of the firms during some years data are missing. By estimating a Heckman-type probit model, we calculate the probability that the firm is included in the sample, on the basis of investment, profit, industry affiliation and firm type.

The estimated investment equation includes cash flow as well as two measures of financial slack. One measure is defined as the sum of cash, short-term receivables and short-term securities; the other measure is the revenue obtained from the sale of non-current tangible assets. Unlike cash flow, these variables measure only the availability of internal

funds and, consequently, will provide further evidence of the existence of credit rationing. The assumption here is that measures of financial slack are not likely to be positively correlated with a firm's future opportunities. Kaplan and Zingales (1997) argue that high levels of financial slack are associated with a lack of financial constraints, given that investment will not be conditioned by the availability of finance. On the other hand, Fazzari, Hubbard and Petersen (1996) and Kim, Mauer and Sherman (1998) argue that high levels of financial slack might be associated with financial constraints given that it is those firms that expect to be constrained that accumulate large holdings of liquidity. These arguments mean that, for financially constrained firms, the coefficients for financial slack variables are expected to be positive and statistically significant, pointing to the inability of these firms to substitute between internal and external finance, while for financially unconstrained firms the coefficients for financial slack variables are not expected to be different from zero, indicating that they can freely switch between internal and external financing.

The literature stresses two motivations for firms to undertake voluntary asset sales. The first is that asset sales allow the firm to restructure operations and achieve greater productive efficiency by offloading unproductive assets (Hite, Owers and Rogers,1987; John and Offek,1995). In this case asset sales are not correlated with future investment opportunities and are expected to provide relief to financially constrained firms. On the other hand, the assumption of no correlation of measures of financial slack and future investment opportunities will be violated when a voluntary asset sale is determined by the likelihood of future constraints, rather than by restructuring considerations. Lang, Poulsen and Stulz (1995) argue that firms that sell assets are poor performers and/or that they have high leverage. This view suggests that asset sales provide funds when alternative sources of finance are too expensive. In this case the causality between asset sales and investment outlays is reversed, but is still expected to be positive and significant for financially constrained firms.

Finally, ownership dummies are included in investment equations to capture differences in investment behavior across firms of different ownership structures that have nothing to do with financial constraints. For example, employee owned firms might be expected to under-invest due to employee owners' risk attitudes, goal structure or the designation of property rights (Dow, 2003).

The switching function, given by equations (2) and (4), it is assumed to be a function of two sets of variables: those that determine the firm's financial status and those that measure the degree of information and agency problems. The former set of variables includes balance sheet and income statement items, such as debt to capital ratio, interest payments to sales ratio and liquid financial assets to capital ratio. The latter set of variables includes the percentage of shares owned by the largest owner, as a measure of ownership concentration, firm's age and firm size. Time and industry dummies complete the set of explanatory variables of the switching function. The straightforward interpretation of the coefficients of these dummies is that they represent the effects of general macroeconomic conditions[23] on the probability of a firm being financially constrained. As these conditions are the same for all the firms in the economy or in an industry, their sum constitutes the threshold over which a firm will be classified as financially constrained based on its own characteristics. Given that being financially constrained at any time will depend on past performance and results, all variables in the switching function other than time and industry dummies enter in the first lag.

This specification of the switching equation would lead to very different sample partition into constrained and unconstrained firms than when sample separation is based on threshold values chosen by us subjectively. Examples of the latter approach would be the use of ownership structures in dividing the sample into insider owned versus outsider owned firms, with state owned firms included in the latter group due to soft budget constraints

considerations, or the use of debt-to-capital and/or liquidity-to-capital ratios to partition the sample.

Firms having a high debt to capital ratio are expected to be suffering either from a lack of collateralizable assets or from exhaustion of existing collateralizable assets and are, therefore, highly likely to be operating in the financially constrained regime. Similarly, firms having a high interest payment to sales ratio, i.e. a heavy burden in servicing the existing debt, are more likely to operate in the financially constrained regime. On the other hand, firms having a high ratio of liquid assets to capital have plenty of resources at their disposal and, consequently, would face a low probability of being financially constrained. This means that, in the switching function specification, the coefficients on the ratios of debt to capital and interest payment to sales are expected to be positive, while the coefficient on liquid assets/ capital is expected to be negative.

However, if firms enjoy easy access to capital or experience soft budget constraints[24], then the effect of financial variables on the probability of being financially constrained either would be insignificant or significantly reduced. The notion of soft budget constraints includes cheap capital provided to firms in the form of direct government subsidies and tax arrears[25], trade credits, and cheap loans from the banking sector. The strict budgetary and competition promoting policies adopted by successive Estonian governments have reduced the level of subsidies provided by direct budgetary policies to minimal levels. Thus, EBRD (2000) reports that, during 1995 through 2000, budgetary subsidies in Estonia were less than 1% of GDP, except for 1995 when they amounted to 1.9% of GDP. As such, direct budgetary subsidies do not constitute an important source of finance for Estonian firms. Tax arrears though might provide a significant means through which the state extends its support to distressed firms. Detailed data on tax arrears are, unfortunately, unavailable from standard financial statements. There is, however, some information that corroborates the existence and pervasiveness of tax

arrears in Estonia. For example, EBRD (2000) stresses that the efficiency of the collection of social security tax at the enterprise level in Estonia was 85.6% in 1998 and 76.2% in 1999. Furthermore, EBRD (1999) presents the results of a firm-level survey carried out in several transition countries. Among other things, firms were asked about their level of tax arrears. The results show that, although among advanced transition economies Estonia is the country with the lowest percentage of firms reporting tax arrears, this problem is found in about 9% of firms.

Another potential source of cheap capital is overdue trade credit to suppliers. As in the case of tax arrears, it is not possible to gauge the importance of trade credit from financial statement data. In the previous section it was shown that current payables are high and increasing over time across all categories of firms. These, however, might not reflect overdue payments but rather contractual arrangements or delivery lags. In fact, it is highly possible that most current payables do not constitute overdue trade credit. Furthermore, if high levels of overdue trade credit are rolled over into long-term liabilities, this will translate into a high growth rate for long-term liabilities. But as seen from the previous section, this growth rate is low for almost all the period. Schaffer (1998) argues that, at least in more advanced transition economies, firms have learnt to apply hard budget constraints to each other[26].

A final alternative measure of soft budget constraints is easy access on the part of distressed or loss-making firms to bank lending through special relations with banks and/or other financial institutions. To properly establish the extent of this channel of soft budget constraints one needs to combine data from both firms and banks. It is tempting to interpret positive net financing from a loss-making firm as evidence of soft budget constraints. However, this would be the case only if the stated loan has a low economic value to the bank itself. Unfortunately, data on whether banks invest in low economic value projects are not available, as banks are reluctant to disclose such information. Two conjectures, however, may

be drawn from the data in Tables 4.1 and 4.2, i.e. the share of investment financed through loans over time. First, if firms in Estonia had widespread easy access to bank loans we would expect the share of investment financed through bank loans to be higher. Second, if certain firms enjoyed special relations with banks we would expect the share of investment financed through bank loans to be either stable or increasing over time. However, from Table 4.2 it is clear that only state owned firms have a share that is more or less stable over time, although the share is small. These facts indicate that, although access to cheap credit might be present in Estonia, it is neither widespread not persistent over time.

Overall, the presence of soft budget constraints would mitigate the severity of financial constraints and, if not accounted for, would provide biased estimates of financial variables that are constructed to measure the probability of a firm being financially constrained. Among the potential channels for soft budget constraints to operate, in Estonia the data clearly show that direct budgetary subsidies are unimportant. Assessing the relative importance of the other three channels is a difficult task, due to the lack of appropriate data, as with tax arrears, or data that is too noisy, as with attempts to isolate trade credit and easy bank loans. Nevertheless, given the theoretical importance of soft budget constraints, we use the available data to construct a dummy variable measure. This takes the value 1 if, at a given time, a firm has negative earnings before interest, taxes and depreciation (EBITD) and, at the same time, receives positive net financing, defined as an increase in short-term debt net of financing costs.[27]

With respect to the second set of variables that enter the switching equation, the percentage of shares owned by the largest owner is used as a proxy for the severity of agency problems, while the firm's age and size are used to proxy the severity of informational asymmetries. The expected sign on the coefficient of the percentage of shares owned by the largest owner is theoretically ambiguous. If it mitigates agency problems, a more concentrated

ownership is expected to lead to a lower probability of a firm being financially constrained. However, if shares are concentrated in the hands of managers and/or employees, insider-outsider conflicts of interests will arise, and this might lead to a higher probability of being financially constrained. A way to test these conflicting hypotheses is to include interaction terms of the percentage of shares owned by the largest owner with respective ownership dummies. The coefficients of these terms are expected to be negative when ownership is concentrated in the hands of outside owners, while they are expected to be positive when ownership is concentrated in the hands of insiders. Furthermore, young firms are expected to be more prone to informational asymmetries than established firms, which have better possibilities of creating long-term relationships with providers of capital than do newly established privatized firms. Consequently, the sign of the coefficient on a firm's age is expected to be negative. Finally, small firms could face a higher premium on external finance due to the higher cost of collecting information on them. In addition, small firms incur higher transaction costs when issuing both debt and equity financing and will face a higher risk of bankruptcy than will large firms. This means that the coefficient of firm's size is also expected to be negative.

The power of this approach stands in tackling the static and dynamic misclassification biases arising in sample separation. The discussion above has highlighted how we have accounted for the static bias. In addition, this approach is justified on the grounds that firms frequently change regimes over time. For instance, in our sample 30% of firms change regimes at least once during the period under consideration, with 18% changing regimes twice and 9% changing regimes three or more times. These data underscore the seriousness of the dynamic misclassification bias and point to the appropriatness of our approach.

4. Empirical Results and Findings

In this section we report the estimates of investment equations[28] and switching function[29] parameters. Due to the long time period under consideration we observe entry of new firms and exit of existing firms from the sample. These decisions are potentially not random and we expect our findings to be sensitive to this phenomenon. As such, we report estimates using both balanced and unbalanced panels[30], which provides evidence of the robustness of results, as well as of the direction and magnitude of the bias caused by entry and exit of firms over time.

In part 1 of Tables 5 and 6 we report the results of estimating investment equations for firms operating in each regime. Except for the time and industry dummies, all other variables in the switching equation are included as first lags. Table 5 presents estimates when the whole (unbalanced) sample is used, while Table 6 presents estimates when only the balanced sub-sample is used. As seen from both tables the coefficient estimates of output (sales) and measures of internal funds across both regimes are mostly statistically significant and of the expected sign, indicating strong support for the neoclassical/accelerator model. These results are in line with those obtained from other studies in both advanced market economies and transition economies, which have used neoclassical/accelerator models of investment behavior and found output and internal funds to be a significant determinant of investment. For example, Lizal and Svejnar (1998) find the sum of coefficients on output to be 0.027 and the sum of coefficients on profit to be 0.019, while Lizal and Svejnar (2002) find those coefficients to be 0.010 and 0.019, respectively[31]. In a study of firms from the three Baltic Republics, Lesnik and Sterken (1998) find that the coefficient on output to be at the range 0.007 to 0.04, while the coefficient on cash flow to be at the range 0.135 to 0.175. These results, however, corresponds to estimates with pooled samples and as such are not directly comparable with our estimates. In a similar study to ours, Hu and Schiantarelli (1998) find the coefficients of sales and cash flow for firms in high-premium (constrained) regime to be 0.001

and 0.192, while for those in low-premium (unconstrained) regime to be 0.035 and 0.053 respectively.

Turning to differences in investment behavior across the two regimes, from Table 5 we see that the coefficients of lagged cash flow variables are statistically significant at either the 5% or 1% levels. Furthermore, as expected, the lagged cash flow coefficient is larger for financially constrained firms than for financially non-constrained firms, i.e., 0.013 versus 0.007. This supports the hypothesis that financially constrained firms are more sensitive to the availability of internal finance than are financially unconstrained firms. The positive and significant coefficient of lagged cash flow for financially unconstrained firms provides evidence that this variable conveys some information on future profitability. Then, the difference of this coefficient between constrained for unconstrained firms is attributed to different sensitivities to the availability of internal funds.

The coefficient of twice lagged cash flow is positive and statistically significant only for firms operating in the financially constrained regime. This might be interpreted as evidence consistent with a cash smoothing or “buffer stock” liquidity hypothesis, i.e., given an inability to secure all desired financing when a profitable investment project is undertaken, financially constrained firms accumulate internal funds over time and use them to finance these projects. Further evidence of different sensitivities to the availability of internal funds across firms operating in the two regimes is given by the coefficients of variables measuring financial slack, i.e., liquid assets and asset sales. The coefficients of lagged liquid assets and its twice lagged value are positive and significant for firms operating in both regimes, with those operating in the constrained regime displaying a higher sensitivity to the availability of liquid assets. This finding implies that all firms accumulate large holdings of liquidity to substitute for their inability to obtain external finance. However, the coefficients of the asset sales variables are statistically significant only for financially constrained firms, implying that

asset sales provide additional funds for investment. In contrast, the coefficients for financially unconstrained firms are positive but statistically insignificant. Finally, support for the hypothesis of different investment behavior across groups is provided by the coefficient estimates of sales and its lagged value. All coefficients are positive and statistically significant at a 1% level, but they are larger in absolute value for unconstrained firms than for constrained firms. This is consistent with the hypothesis that unconstrained firms are able to react more to the prospect of future growth opportunities, summarized by the sales variable, than are firms operating in the constrained regime.

Finally, the signs and significance of ownership dummies reveal notable differences across the two regimes. The coefficients should be interpreted as the differential effect of a particular ownership structure on investment over the control group of state ownership. Surprisingly, ownership structure does not seem to matter when firms operate in the financially unconstrained regime. On the contrary, ownership structure leads to differences in investment behavior only for firms that operate in the financially constrained regime. More specifically, investment in constrained firms increases with foreign ownership and decreases with employee and managerial ownership. In the latter case this phenomenon might reflect the preferences and goals of insider owners, who might prefer to divert resources in higher individual income rather than invest in the firm. Although, in principle, insiders, and especially non-managerial employees, own the shares individually there is empirical evidence[32] to show that there exist a strong degree of collective ownership. This fact makes our findings in line with those of Estrin and Jones (1998), who find that investment in employee owned firms decreases with the share of capital, which is collectively owned.

Turning to the results obtained from the balanced panel (reported in Table 6), we see that the signs and statistical significance of coefficients are essentially the same as those obtained from the unbalanced panel, implying that results are robust and not affected by entry

and exit of firms over time. The coefficient of the lagged cash flow variable is again larger for financially constrained firms (0.018 versus 0.003). Financially constrained firms are also found to have positive and statistically significant coefficients on financial slack variables. However, in terms of coefficient magnitudes there are differences between findings for the balanced and unbalanced panels. Most of the coefficients obtained from the balanced panel are larger in absolute value than those obtained from the unbalanced panel. Thus it is tempting to conclude that entry and exit of firms over time causes a downward bias in coefficient estimates. In terms of the estimated coefficients for the ownership dummies, findings are essentially unchanged.

The existence of two distinct investment regimes can be tested using appropriate likelihood ratio tests. However, under the restriction that the coefficients of the two investment equations are equal, the parameters of the switching equation are not identified, which makes it difficult to calculate degrees of freedom. In addition, the likelihood ratio test statistic might not be asymptotically distributed as χ^2 distribution. Yet, Goldfeld and Quandt (1976) have suggested that the likelihood ratio test can be performed using a χ^2 distribution with degrees of freedom equal to the sum of the number of constraints and the number of unidentified parameters. In the above models the number of degrees of freedom is 45 when the balanced panel is used and 46 when the unbalanced panel is used, with the difference reflecting the inclusion of the inverse Mill's ratio in the investment specification when the unbalanced panel is used. When the likelihood ratio tests are performed, for both panels the null hypothesis of a single regime is decisively rejected.[33]

Next we test for the equality of individual coefficients in investment equations across the two regimes. More specifically, we test whether the coefficient of lagged cash flow is equal for firms operating in the financially constrained regime and those operating in the financially unconstrained regime. The t-statistic for the unbalanced panel is 7.47, while for the

balanced panel is 10.13, leading in both cases to decisive rejection of the null hypothesis. In the case of the coefficient of lagged sales, the respective t-statistics are 5.07 for the unbalanced panel and 9.78 for the balanced panel, again leading to rejection, at high levels of statistical significance, of the null hypothesis. Similar tests are performed for the other variables in the investment equations and in all cases we are able to reject the null of coefficients equality.

Turning to estimates of the switching equations, an important general conclusion that emerges is that both balance sheet, and information asymmetry and agency cost variables are important determinants of the likelihood of whether the firm is financially constrained or not. In both Tables 5 and 6 the coefficients of debt to capital and interest payment to sales ratios are positive, although not always significant, indicating that, as expected, higher values of these ratios make a firm more likely to operate in the financially constrained regime. Furthermore, the coefficient of liquidity to capital ratio is negative and significant at 1% significance level, indicating that the higher the ratio the lower the likelihood the firm will operate in the financially constrained regime.

The coefficients of the variable that interacts the percentage of shares owned by the largest owner with the appropriate measure of ownership are mostly significant, indicating that ownership concentration is important in determining the regime in which a firm operates. The signs of the coefficients, however, are essentially similar across panels, except for the coefficient of the shares owned by managers. For instance, in the unbalanced panel estimates, the coefficients of the percentage of shares owned by the state and employees are positive and statistically significant, suggesting that higher ownership concentration in the hands of either the state or employees is associated with a higher probability of being financially constrained. In between these groups, when ownership is concentrated in the hands of employees the effect is almost twice as large as when ownership is concentrated in the hands of the state.

Interestingly, there seems to be no significant effect of the likelihood of being financially constrained when ownership is concentrated in the hands of the domestic outsiders and foreigners, while ownership concentration in the hands of managers leads to a lower probability of being financially constrained. However, a different picture sometimes emerges when the balanced panel is used. As before, ownership concentration in the hands of the state or employees is detrimental to the probability of being financially constrained. Also, foreign ownership concentration still shows no significant effect on the probability of being financially constrained. However, the effect of ownership concentration in the hands of other owners is different. Concentration of shares in the hands of managers is now found to increase the probability of the firm being financially constrained, while the reverse is true when ownership is concentrated in the hands of domestic outsiders. Similarly to our findings, Djankov and Murrell (2002) find that estimated coefficients of the effect of managerial ownership on firm performance are sensitive to how the selection bias is handled. Contrary to expectations, however, the negative effect of the concentration of ownership in the hands of employees is smaller than that of the concentration of ownership in the hands of managers.

The coefficients on firm size, firm age and the dummy for soft budget constraints, are each found to have the expected sign, although firm age coefficient is insignificant for the unbalanced sample. These findings indicate that larger firms, more established firms and firms that have access to finance from sources other than the market are less likely to find themselves operating in the financially constrained regime. In a survey of the literature, Djankov and Murrell (2002) find a positive and significant effect of hardened budget constraints on enterprise restructuring, defined as sales growth, TFP or labor productivity. In light of these findings, our conclusions suggest that funds obtained as soft credits are possibly used in unproductive and inefficient way. In an alternative specification, to test whether balance sheet status is more important for firms that are subject to more severe asymmetric

information problems, we also included in the switching regression variables for firm size and firm age interacted with the debt to capital ratio, the liquidity to capital ratio and the interest coverage to sales ratio. Since none of the interaction effects was found to be statistically significant, we do not report them.

An advantage of using the switching regression approach is that it allows easy calculation of the probabilities that firms operate in one or the other regime. In Tables 7.1 and 7.2 we report probabilities over time that firms, belonging to different ownership groups, operate in the financially constrained regime for the unbalanced and balanced panel respectively. Several important findings emerge from these tables. First, the probabilities of being financially constrained are quite high and are stable over time. Second, consistent with the finding that the identity of owners matters with respect to access to finance, there are substantial differences in probabilities across ownership groups. Thus firms under foreign ownership face the lowest probability of being financially constrained. This is consistent with the argument that foreign owners either have access to alternative capital markets or manage to crowd out domestic demand for capital, given their potentially higher creditworthiness. Yet, a lot of foreign owned firms seem to be financially constrained. This could be driven from the fact that 47% of foreign owned firms are small firms as well as that a lot of them are direct investments of foreign entities rather than subsidiaries of or joint ventures with foreign companies, i.e., they lack a direct and potentially unconstrained source of financing if financially distressed. Under these conditions, these firms are obliged to borrow in an underdeveloped capital market and compete for funds with other firm types in the economy. Further, and consistent with the results of the switching function, insider owned firms are found to face higher probabilities of being financially constrained than are private outsider owned firms. This is especially the case for the balanced panel where both manager and employee owned firms face higher probabilities of being financially constrained compared

with foreign and domestic outsider owned firms. In order to check the statistical significance of these differences we perform mean difference tests, not reported here, for each pair of ownership groups for every year. In no case are we able to accept the null that insider and private outsider owned firms have equal probabilities of being financially constrained. Finally, state owned firms are financially constrained over the whole period under consideration. This result might seem surprising in light of the expectation that state owned firms might be subject to soft budget constraints. However, it perhaps means that, throughout the period, these firms were required to borrow in the capital market, where they had to face the competition of private firms. The strict monetary and budgetary policies of Estonian governments that led to direct budget subsidies of only about 1% of GDP per year provide support to this conjecture Third, there seems to be a weak tendency in that the probabilities are higher for the first and last year, indicating that probabilities of being financially constrained are larger during the early transition years as well as during the 1998-1999 when Estonia was strongly affected by the Russian crisis.

5. Conclusions

In this paper we analyze the investment behavior and the determinants of financial constraints for a panel of Estonian companies during 1993 through 1999. Our using a switching regression framework, when sample separation is unknown and endogenous, represents the first application of this approach when studying investment behavior in a transition economy. The major benefit of using this approach is that it eliminates the bias generated from misclassification when a single classification criterion is used to partition the sample. Furthermore, our findings provide further evidence on the performance of the accelerator/neoclassical model of investment behavior, as well as fresh evidence for hypotheses concerning the impact of a firm's ownership structure and the degree of informational asymmetries and agency costs on the determination of investment. Finally, our

approach allows us to calculate probabilities that firms with different ownership structures will operate in the financially constrained regime at a particular time, and to analyze changes in these probabilities as transition proceeds.

In the model, firms are assumed to be operating in either the financially constrained or the non-constrained regime. The regime in which a firm operates at a given time is not known beforehand, and is endogenously determined by a selection equation. This is modeled to be function of three key balance sheet variables (the debt to capital ratio, the interest coverage to sales ratio and the liquidity to capital ratio), as well as three variables that proxy the degree of asymmetric information and agency problems (the percentage of shares owned by the largest owner, firm age and firm size.) In addition, our approach allows us to take account of the fact that the effect of these variables on the probability of a firm operating in the constrained regime would be strongly moderated if firms would enjoy easy access to capital in the form of soft loans, overdue payments to suppliers, tax arrears and/or straightforward budgetary subsidies.

Our findings confirm the existence of two separate investment regimes for financially constrained and unconstrained firms. Furthermore, to explain the investment behavior of firms our preferred specification is not the basic accelerator/neoclassical model of investment, but rather such a model that is augmented with financial variables to approximate financing constraints. The results confirm the hypothesis that financially constrained firms are sensitive to the availability of internal finance, while financially non-constrained firms are more responsive to future growth opportunities. The sign and magnitude of these results are often consistent with existing findings in the literature, both for advanced market as well as transition economies. Yet, our interpretation of certain coefficients is sometimes different. For example, we have allowed the coefficients on cash flow variables to capture future profit prospects besides access to finance. Under this assumption a significant coefficient of cash

flow for the financially unconstrained firms captures investment sensitivity to future prospects and the difference in coefficients between financially constrained and unconstrained firms captures sensitivity to access to finance. Then, we focus on the difference of cash flow coefficients between financially constrained and unconstrained firms as indicator of financing constraints. The importance of internal funds in investment decisions for financially constrained firms is further corroborated by the significance of variables that measure financial slack, included to measure only the availability of internal finance. These findings support the claim, of Calvo and Coricelli (1994), that investment behavior of firms in transition economies is consistent with a financing hierarchy theory.

With respect to the likelihood of firms being financially constrained or not, our findings point to the importance of the firm's balance sheet position, as well as to variables that proxy the severity of information asymmetry and agency costs. In general, our results indicate that firms with a weak balance sheet position and those facing more severe asymmetric information and agency costs problems are more likely to operate in the financially constrained regime. More specifically, a higher ratio of debt to capital, a bigger ratio of interest coverage to sales, and a lower liquidity to capital ratio increase the probability of a firm being financially constrained. This probability is also higher for newly privatized and smaller firms, as well as for those in which ownership is concentrated in the hands of insiders and the state. We also find that the existence of soft budget constraints lowers the probability of a firm being financially constrained. When actual probabilities of operating in the financially constrained regime are calculated, it is found that they are quite high and basically stable during the whole period. Overall, the analysis has shown the importance of different capital market imperfections in firm's investment decisions.

The conclusions point to the importance of ownership configurations for both investment behavior and the likelihood of facing financial constraints. As expected firms

whose ownership structures are dominated by insiders face higher probability of being financially constrained and display higher sensitivity to availability of internal finance. Moreover, ownership structure affects investment beyond its indirect effects through financial constraints, reflecting factors such as owners' preferences and goals in allocating the funds. Allowing us to distinguish between these differential effects of ownership structures on investments adds further weight to the appropriateness of this approach.

Table 1. Financial Institutions Indicators[a]

Indicators	1993	1994	1995	1996	1997	1998	1999	2000
Number of Banks Operating in Estonia	21	22	18	15	12	6	7	7
Number of Foreign-Owned Banks	1	1	4	3	3	2	2	4
Share of Bank Assets Owned by the State	25.7	28.1	9.7	6.6	0.0	7.8	7.9	0.0
Non-performing Loans (as % of Total Loans)	n.a.	3.5	2.4	2.0	2.1	4.0	2.9	1.5
Credit to Private Sector (as % of GDP)	11.1	13.4	14.7	19.2	26.4	25.2	25.9	25.9
Stock Market Capitalization (as % of GDP)	n.a.	n.a.	n.a.	16.7	24.7	9.4	36.6	35.2
Net Foreign Direct Investment (in millions of USD)	156	212	199	111	130	574	222	324

[a] The source of the data is EBRD Transition Report 2001.

.

Table 2. Variable Definitions

Variable	Definition
Investment	The sum, in real terms, of investments in reconstruction, expansion and acquisition of buildings, in constructions of new buildings and other business related projects, in buying new machinery, equipment and means of transportation and in buying and improving land.
Capital	The book value, in real terms, of non-current tangible assets, calculated as the average of the value of these assets at the beginning and at the end of the year.
Employment	The average number of employees per year. We have excluded all firms with fewer than 10 employees.
Labor Cost	The sum, in real terms, of wages and salaries in a given year.
Average Wage	The ratio of labor cost to average employment in a given year.
Sales	Net sales per year in real terms.
Profit	Net profit per year in real terms. This is profit left after all taxes are paid.
Cash Flow	The sum, in real terms, of depreciation allowances and net profit.
Debt	The sum, in real terms, of short-term loans.
Current Liabilities	The sum, in real terms, of short-term loans and payables to suppliers and or customers.
Total Liabilities	The sum, in real terms, of short and long-term loans and other short and long-term liabilities.
Liquid Assets	The average per year of the sum, real terms, of cash, short-term receivables and short-term securities.
Financial Cost	The net, in real terms, of financial income accrued and financial cost incurred during a given year.
Asset Sale	Revenue, in real terms, obtained from sale of non-current tangible assets over a given period.
Industry Groups	7 broad industry groups were defined as follows: 1. Agriculture and fishing. 2. Mining, food products, textile and leather. 3. Wood products, paper products, coke, petroleum, chemicals, rubber, plastic, non-metallic, basic metals and machinery and equipment production. 4. Electrical, optical and transport equipment production. 5. Energy and construction. 6. Wholesale and retail trade. 7. Transport.
Size Groups	Firms are divided into three size groups according to their average employment. The first group includes firms with 49 or fewer employees, the second includes the firms with more than 49 employees and fewer than 101, and the third group includes firms with more than 101 employees.
Ownership Groups	6 ownership groups are defined as follows: state, foreign, institutional domestic outsiders, former employees, incumbent employees and managers.
Ownership Categories	Ownership categories are classified according to dominant ownership whereby a dominant owner holds the largest share of the voting stock.
Ownership Share	The share owned by the respective ownership group.
Debt to Capital	The ratio of debt to capital.
Interest Coverage to Sales	The ratio of interest expenses to net sales.
Liquid Assets to Capital	The ratio of liquid assets to capital.
Firm Age	The number of years the firm has been operated as a private entity.
Size	The logarithm of the average number of employees.
Soft Budget Constraint	A dummy variable that takes the value of 1 if the firm has negative EBITD and receives positive net financing defined as an increase in short-term debt net of financing costs.
Largest Share	The percentage of shares owned by the largest owner group

Table 3.1 Means and Standard Deviations of Principal Variables Over Time for the Unbalanced Panel

Year / **Variables**[1]	1993	1994	1995	1996	1997	1998	1999	Obs.[2]
Investment	2150 (12363)	2245 (18844)	3371 (22029)	3007 (17249)	2634 (15504)	3407 (14019)	4547 (19549)	3294
Capital	12250 (51023)	9740 (48137)	9771 (45305)	10329 (47218)	10411 (47756)	11200 (49623)	16816 (43022)	3294
Sales	21773 (63301)	21502 (61562)	30377 (93119)	24269 (69179)	27573 (77562)	27989 (63535)	32816 (88789)	3294
Employment[3]	196 (414)	166 (340)	164 (388)	161 (393)	157 (276)	137 (282)	124 (228)	3294
Real Wage[4]	14.42 (17.11)	16.46 (10.91)	13.31 (7.73)	21.04 (30.59)	21.92 (17.28)	22.96 (14.63)	28.37 (18.33)	3294
Cash Flow	805 (7530)	649 (8801)	1103 (10008)	658 (12607)	1678 (14428)	1994 (18195)	2932 (17328)	3294
Debt	867 (2692)	891 (4112)	1389 (3974)	1701 (4007)	1717 (3664)	2276 (3885)	2962 (4127)	3294
Current Payables	5516 (23301)	4848 (21130)	3804 (11895)	4334 (12503)	4363 (10672)	4605 (12843)	5445 (15750)	3294
Long-Term Liabilities	2595 (14961)	2702 (19652)	3143 (12450)	3433 (12048)	3820 (13874)	4469 (12052)	6863 (16384)	3294

[1]All the variables except employment are expressed in thousands of Estonian kroons and in 1993 prices
[2]This number is the sum over the whole sample with non-missing values for the respective variable
[3]Average number of employees in a given year
[4]Real average wage per employee

Table 3.2 Means and Standard Deviations of Principal Variables Over Time for the Balanced Panel

Year / **Variables**[1]	1993	1994	1995	1996	1997	1998	1999	Obs.[2]
Investment	2920 (17750)	3881 (28383)	5479 (28771)	3984 (24439)	3436 (22406)	4539 (22525)	4989 (24834)	1491
Capital	16335 (60350)	13100 (55389)	15064 (54972)	13105 (53733)	12523 (45747)	14178 (47487)	16806 (48520)	1491
Sales	22246 (50611)	23386 (50009)	35639 (79458)	22801 (51548)	27634 (62035)	31008 (72934)	35308 (81817)	1491
Employment[3]	197 (394)	174 (365)	161 (334)	149 (306)	144 (297)	138 (279)	125 (256)	1491
Real Wage[4]	14.42 (8.57)	17.14 (8.98)	14.11 (7.80)	20.14 (11.04)	22.04 (12.12)	23.96 (15.00)	28.13 (17.65)	1491
Cash Flow	1355 (6895)	1562 (8304)	1804 (11728)	1638 (14312)	2812 (18763)	3302 (22282)	3957 (18062)	1491
Debt	1054 (3195)	1269 (5837)	1279 (2947)	1707 (5449)	1630 (4401)	2613 (7497)	3077 (6805)	1491
Current Payables	5991 (16569)	5594 (15302)	5222 (11535)	5782 (12822)	6004 (12875)	7081 (17126)	8300 (19081)	1491
Long-Term Liabilities	4407 (17043)	4307 (21776)	4733 (13444)	4941 (13580)	5350 (34570)	5580 (31480)	5789 (22193)	1491

[1]All the variables except employment are expressed in thousands of Estonian kroons and in 1993 prices
[2]This number is the sum over the whole sample with non-missing values for the respective variable
[3]Average number of employees in a given year
[4]Real average wage per employee

Table 4.1 Share of Investment Financed Through Internal Funds Over Time According to Dominant Owner[1]

Year / Ownership Group	1993	1994	1995	1996	1997	1998	1999
Domestic Outsider	0.94	0.85	0.95	0.88	0.94	0.94	0.99
Employee	0.73	0.60	0.98	0.97	0.94	0.92	1.00
Former Employee			1.00	1.00	1.00	0.91	0.92
Foreign	0.76	0.63	0.91	0.94	0.84	0.88	0.86
Manager	0.90	0.82	0.93	0.92	0.95	0.96	0.96
State	0.89	0.86	0.94	0.94	0.96	0.96	1.00

[1] A firm is considered to be dominantly owned by the owner who holds the largest share.

Table 4.2 Share of Investment Financed Through Loans Over Time According to Dominant Owner[1]

Year / Ownership Group	1993	1994	1995	1996	1997	1998	1999
Domestic Outsider	0.06	0.15	0.05	0.11	0.06	0.03	0.01
Employee	0.16	0.31	0.02	0.03	0.06	0.08	0.00
Former Employee			0.00	0.00	0.00	0.09	0.08
Foreign	0.06	0.22	0.02	0.00	0.07	0.04	0.08
Manager	0.00	0.10	0.07	0.04	0.02	0.03	0.01
State	0.05	0.04	0.03	0.04	0.02	0.04	0.00

[1] A firm is considered to be dominantly owned by the owner who holds the largest share

Table 5. Coefficient Estimates for Two-Component Investment Regression and Switching Equation Using the Unbalanced Sample and the Extended Version of the Switching Equation[1]

Unbalanced Panel						
Part 1						
Investment Equation[2]	Lagged Sales	Twice Lagged Sales	Lagged Cash Flow	Twice Lagged Cash Flow	Lagged Liquid Assets	Twice Lagged Liquid Assets
Constrained Regime	0.019* (4.12)	0.005* (17.12)	0.013* (4.68)	0.002** (2.51)	0.031** (2.36)	0.019*** (1.12)
	Lagged Asset Sales	Twice Lagged Asset Sales	Domestic Outsider	Foreign	Manager	Employee
	0.044* (8.16)	0.032** (2.06)	0.001*** (1.59)	0.009* (3.32)	-0.003 (0.92)	-0.005* (3.95)
N/Constrained Regime	Lagged Sales	Twice Lagged Sales	Lagged Cash Flow	Twice Lagged Cash Flow	Lagged Liquid Assets	Twice Lagged Liquid Assets
	0.079* (14.27)	0.012** (8.09)	0.007** (1.69)	0.010 (0.99)	0.019** (1.94)	0.008*** (1.54)
	Lagged Asset Sales	Twice Lagged Asset Sales	Domestic Outsider	Foreign	Manager	Employee
	0.021 (0.67)	0.012 (0.63)	0.004 (0.31)	0.007 (1.12)	0.0001 (0.08)	-0.004 (-0.14)
Part 2						
Switching Equation[3]	Debt-to-Capital Ratio	Liquidity-to-Capital Ratio	Int. Coverage – to – Sales Ratio	Size	Age	SBC
Coefficient Estimates	0.022* (7.29)	-0.002* (-6.47)	0.057** (2.01)	-0.026* (-9.12)	-0.078 (-0.96)	-0.021** (-1.95)
	Largest Share*State	Largest Share*Domestic	Largest Share*Foreign	Largest Share*Manager	Largest Share*Employee	
	0.019* (11.47)	0.089 (1.08)	0.009 (0.57)	-0.008* (-18.63)	0.037** (2.23)	

[1] * - significant at 1% confidence level, ** - significant at 5% confidence level, *** - significant at 10% confidence level. Numbers in parentheses are *t*-statistics of coefficient estimates.

[2] The dependent variable is investment in fixed capital divided by lagged capital stock. The right hand side variables presented are also divided by lagged capital stock. Each estimated investment equation also includes a constant, time and industry dummies as well as the inverse of Mill's ratio to account for selection bias.

[3] The dependent variable is an indicator taking value of 1 for firms classified as financially constrained and 0 for those classified as not financially constrained. The right hand side variables, other than time and industry dummies, enter in first lags.

Table 6. Coefficient Estimates for Two-Component Investment Regression and Switching Equation Using the Balanced Sample and the Extended Version of the Switching Equation[1]

Balanced Panel						
Part 1						
Investment Equation[2]	Lagged Sales	Twice Lagged Sales	Lagged Cash Flow	Twice Lagged Cash Flow	Lagged Liquid Assets	Twice Lagged Liquid Assets
Constrained Regime	0.025** (2.28)	0.008** (2.06)	0.018* (5.18)	0.005** (2.47)	0.028* (7.12)	0.014** (2.30)
	Lagged Asset Sales	Twice Lagged Asset Sales	Domestic Outsider	Foreign	Manager	Employee
	0.031** (1.94)	0.022* (6.06)	0.002** (2.22)	0.010* (3.69)	-0.005** (-2.14)	-0.009* (-4.48)
N/Constrained Regime	Lagged Sales	Twice Lagged Sales	Lagged Cash Flow	Twice Lagged Cash Flow	Lagged Liquid Assets	Twice Lagged Liquid Assets
	0.068* (7.28)	0.008*** (1.19)	0.003** (2.69)	0.0012 (0.86)	0.018** (2.14)	0.005*** (1.09)
	Lagged Asset Sales	Twice Lagged Asset Sales	Domestic Outsider	Foreign	Manager	Employee
	0.028 (1.09)	0.011 (0.85)	0.001 (1.12)	0.006 (0.73)	-0.001 (-1.03)	-0.006 (-0.69)
Part 2						
Switching Equation[3]	Debt-to-Capital Ratio	Liquidity-to-Capital Ratio	Int. Coverage – to – Sales Ratio	Size	Age	SBC
Coefficient Estimates	0.041* (9.02)	-0.01* (-4.98)	0.009 (1.12)	-0.083* (-5.61)	-0.049* (-6.47)	-0.104* (-3.29)
	Largest Share*State	Largest Share*Domestic	Largest Share*Foreign	Largest Share*Manager	Largest Share*Employee	
	0.067* (8.51)	0.042* (3.69)	-0.002 (-0.68)	0.103* (7.19)	0.097* (9.25)	

[1] * - significant at 1% confidence level, ** - significant at 5% confidence level, *** - significant at 10% confidence level. Numbers in parentheses are *t*-statistics of coefficient estimates.

[2] The dependent variable is investment in fixed capital divided by lagged capital stock. The right hand side variables presented are also divided by lagged capital stock. Each estimated investment equation also includes a constant, time and industry dummies.

[3] The dependent variable is an indicator taking value of 1 for firms classified as financially constrained and 0 for those classified as not financially constrained. The right hand side variables, other than time and industry dummies, enter in first lags.

Table 7.1 The Average Probability of Being in the Financially Constrained Regime Over Time and Across Ownership Groups for the Unbalanced Sample

Ownership Group / **Year**	State	Foreign	Domestic	Manager	Employee
1995	0.604	0.356	0.459	0.421	0.612
1996	0.543	0.319	0.431	0.409	0.578
1997	0.551	0.306	0.426	0.395	0.582
1998	0.570	0.312	0.457	0.438	0.571
1999	0.592	0.381	0.482	0.452	0.590

Table 7.2. The Average Probability of Being in the Financially Constrained Regime Over Time and Across Ownership Groups for the Balanced Sample

Ownership Group / **Year**	State	Foreign	Domestic	Manager	Employee
1995	0.569	0.318	0.428	0.413	0.574
1996	0.521	0.296	0.416	0.401	0.549
1997	0.529	0.289	0.404	0.386	0.557
1998	0.558	0.305	0.441	0.416	0.532
1999	0.571	0.366	0.467	0.429	0.567

B I B L I O G R A P H Y

Anderson. Ronald and Chantal Kegels. 1997. "Finance and Investment In Transition: Czech Enterprises. 1993-1994." The William Davidson Institute Working Paper Series. No. 164.

Berengaut. Julian. Augusto Lopez-Claros. Francoise Le Gall. Dennis Jones. Richard Stern. Ann-Margret Westin. Effie Psalida and Pietro Garibaldi. 1998. "The Baltic Countries: From Economic Stabilization to EU Accession." International Monetary Fund. Occasional Paper Series. No. 173.

Berglof. Erik and Patrick Bolton. 2002. “The Great Divide and Beyond: Financial Architecture in Transition.” Journal of Economic Perspective Volume 16(1): 77-100.

Bratkowski. Andrzej. Irena Grosfeld and Jacek Rostowski. 2000. "Investment and Finance in De Novo Private Firms: Empirical Results From the Czech Republic. Hungary and Poland." Economics of Transition. Volume 8(1): 101-116.

Budina. Nina. Harry Garretsen and Eelke de Jong. 2000. "Liquidity Constraints and Investment in Transition: The Case of Bulgaria." Economics of Transition. Volume 8(2): 453-475.

Calvo. Guilermo A. and Fabrizio Coricelli. 1994. “Capital Market Imperfections and Output Response in Previously Centrally Planned Economies.” In: Building Sounds Finance in Emerging Market Economies. Caprio G.. D. Folkerts-Landau and T. Lane (Eds.). Washington DC. International Monetary Fund.

Chirinko. Robert S.. 1988. "Business Tax Policy. The Lucas Critique and Lessons From the 1980s." The American Economic Review Papers and Proceedings. Volume 78 (2): 206-210.

Cleary. Sean. 1999. 'The Relationship Between Firm Investment and Financial Status.' The Journal of Finance. Volume 54(2): 673-692.

Djankov, Simeon and Peter Murrell. 2002. "Enterprise Restructuring in Transition: A Quantitative Survey." Journal of Economic Literature. Volume 40(3): 739-792.

Dow. Gregory K.. 2003. Governing the Firm: Workers' Control in Theory and Practice. Cambridge University Press.

Estonia Statistical Yearbook. 1995. Statistical Office of Estonia. Tallin.

Estrin, Saul and Derek C. Jones. 1998. "The Determinants of Investment in Employee-Owned Firms: Evidence From France." Economic Analysis, Volume 1 (1): 17-28.

European Bank for Reconstruction and Development. Transition Reports 1994-2002.

Fazzari. Steven M.. Glenn R. Hubbard and Bruce C. Petersen. 1996. 'Financing Constraints and Corporate Investments: Response to Kaplan and Zingales.' NBER Working Paper Series. No. 5462.

Filer. Randall K. and Jan Hanousek. 2002. "Data Watch: Research Data From Transition Economies." Journal of Economic Perspectives. Volume 16(1): 225-240.

Goldfeld. Stephen M. and Richard E. Quandt. 1976. “Techniques for Estimating Switching Regressions.” In: Studies in Non-linear Estimation. pp: 3-35. Eds. Goldfeld. Stephen M. and Richard E. Quandt. Ballinger Publishing Company. Cambridge Massachusets.

Hayashi. F. and T. Inoue. 1991. “The Relation Between Firm Growth and Q With Multiple Capital Goods: Theory and Evidence From Japanese Panel Data.” Econometrica. Volume 59 (3): 731-753.

Hite. Gailen L.. James E. Overs and Ronald C. Rogers. 1987. “The Market for Interfirm Asset Sales: Partial Sell-offs and Total Liquidations.” Journal of Financial Economics. Volume 18: 229-252.

Hobdari. Bersant. 2003. “Does Owner(s) Identity Matter? An Empirical Investigation of the Impact of Corporate Governance Structures on Capital Allocation. Investment and Financial Constraints.” PhD Thesis. Copenhagen Business School. No. 10.

Hu. Xiaoqiang and Fabio Schiantarelli. 1998. “Investment and Capital Market Imperfections: A Switching Regression Approach Using U.S. Firm Panel Data.” The Review of Economics and Statistics. Volume 80 (3): 466-479.

Jensen. Michael C.. 1986. "Agency Costs of Free Cash Flow. Corporate Finance and Takeovers." American Economic Review Papers and Proceedings. Volume 76 (2): 323-329.

John. Kose and Eli Ofek. 1995. “Asset Sale and Increase in Focus.” Journal of Financial Economics. Volume 37: 105-126.

Jorgenson. Dale W.. 1963. “Capital Theory and Investment Behavior.” American Economic Review Papers and Proceedings. Volume 53 (2): 247-259. Also in: Investment Volume 1: Capital Theory and Investment Behavior. pp. 1-16. Ed. Dale W. Jorgenson. The MIT Press. Cambridge Massachusetts. London. England.

Jorgenson. Dale W.. 1971. “Econometric Studies of Investment Behavior: A Survey.” Journal of Economic Literature. Volume 9 (4): 1111-1147.

Jorgenson. Dale W. and Calvin D. Siebert. 1968. “A Comparison of Alternative Theories of Corporate Investment Behavior.” American Economic Review. Volume 58(4): 681-712.

Kalmi, Panu. 2002. On the (In)stability of Employee Ownership: Estonian Evidence and Lessons for Transition Economies. Ph.D. Dissertation. Copenhagen Business School, Ph.D. Serie 10.

Kaplan. Steven N. and Luigi Zingales. 1997. “Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints.” Quarterly Journal of Economics. Volume 112 (1): 169-215.

Kim. C.. D. Mauer and A. Sherman. 1998. “The Determinants of Corporate Liquidity: Theory and Evidence.” Journal of Financial and Quantitative Analysis. Volume 33(3): 335-360.

Kornai. Janos. 1980. Economics of Shortage. North Holland. Amsterdam. New York and Oxford.

Koyck. L. M. 1954. Distributed Lags and Investment Analysis. In: Contributions to Economic Analysis Series. North-Holland Publishing Company. Amsterdam.

Lang Larry. Annette Poulsen and Rene Stulz. 1995. “Asset Sales. Firm Performance and the Agency Costs of Managerial Discretion.” Journal of Financial Economics. Volume 37: 3-37.

Lesink, Robert and Elmer Sterken. 1998. "Investment, Financing and Uncertainty in the Baltic States." Tartu University Working Paper Series, No. 26.

Lizal. Lubomir and Jan Svejnar. 1998. "Enterprise Investment During the Transition: Evidence From Czech Panel Data." CEPR Discussion Paper Series. No. 1835.

Lizal. Lubomir and Jan Svejnar. 2002. "Investment. Credit Rationing and the Soft-Budget Constraint: Evidence From Czech Panel Data." Review of Economics and Statistics. vol. 84(2): pp. 353-370.

Maddala. G. S.. 1986. "Disequilibrium. Self-Selection and Switching Models." In: Handbook of Econometrics. Volume III: pp. 1633-1688. Ed. Z. Griliches and M. D. Intriligator. Elsevier Science Publishers BV.

Maddala. G. S. and F. Nelson. 1994. “Switching Regression Models With Exogenous and Endogenous Switching.” In: Maddala G. S. editor: Econometric Methods and Apllications. Volume 2. Economists of the Twentieth Century Series. Aldershot. UK: pp. 369-372.

Mygind. Niels. 2000. “Privatization. Governance and restructuring of Enterprises in the Baltics.” OECD Working Paper Series. No. 6.

Nabi. Ijaz. 1989. "Investment in Segmented Capital Markets." The Quarterly Journal of Economics. Volume 104 (3): 453-462.

Oliner. Stephen D.. Glenn D. Rudebusch and Daniel Sichel. 1995. "New and Old Models Of Business Investment: A Comparison of Forecasting Performance." Journal of Money. Credit and Banking. Volume 27 (3): 806-826.

Oliner. Stephen D.. Glenn D. Rudebusch and Daniel Sichel. 1996. "The Lucas Critique Revisited: Assessing the Stability of Empirical Euler Equations for Investment." Journal of Econometrics. Volume 70 (1): 291-316.

Schaffer. Mark E.. 1998. “Do Firms in Transition Economies Have Soft Budget Constraints? A Reconsideration of Concepts and Evidence.” Journal of Comparative Economics. Volume 26(1): 80-103.

Schiantarrelli. Fabio. 1996. "Financial Constraints and Investment: Methodological Issues and International Evidence." Oxford Review of Economic Policy. Volume 12 (2): 70-89.

Wedel. Michel and Wagner Kamakura. 2000. Market Segmentation: Conceptual and Methodological Foundations. Kluwer Academic Publishers.

Zeldes. Stephen P. 1989. "Consumption and Liquidity Constraints: An Empirical Investigation." Journal of Political Economy. Volume 97 (2): 305-346.

Endnotes

[1] First, the performance of investment demand models, even after being augmented with financial variables, is often not satisfactory in that they leave a large part of investment variation unexplained. Second, as pointed out by Zeldes (1989) the use of structural models, especially in short panels, might fail to detect financial constraints when their tightness is almost constant over time. Furthermore, there is some evidence of poor forecasting performance and parameter instability over time when estimating such equations as evidenced by Chirinko (1988), Hayashi and Inoue (1991), Oliner, Rudebusch and Sichel (1995), and Oliner, Rudebuch and Sichel (1996). Third, reliance on internal finance might not reflect financial constraints but rather behavior resulting from managers' and/or insider owners' preferences, such as aversion to outside control, and/or the use of an objective function other than maximization of dividends (dividends per capita) or even be due to Jensen's (1986) "free cash flow", defined as the amount of cash at firm's disposal above that needed to cover profitable investment opportunities, hypothesis. Empirically it is difficult to disentangle these effects because they involve unobservables and, unsurprisingly, the available evidence, reviewed in Schiantarelli (1996), is mixed.

[2] Although the use of multiple partition indicators is not ruled out, by interacting these indicators the sub-sample sizes will shrink, while the number of parameters to be estimated will increase rapidly and this might lead to imprecise inferences.

[3] Although it started functioning as a central bank only after independence, with the local branch of a Soviet bank carrying out the central bank duties up to that time.

[4] The increased state's share for 1998 is due to the re-nationalization of a bank that became insolvent during 1998. In 2000 this bank was sold to a Finnish financial group bringing the state's share in the banking sector back to zero.

[5] The data cover credit extended to households as well as to enterprises.

[6] The small nature of the market becomes clear by one example: flotation of Estonian Telecom in February 1999 increased market capitalization by 50%.

[7] This includes both the Tallin Stock Exchange and Over The Counter market.

[8] Another source of external funds is foreign direct investment (FDI). In the long run, it is expected that firms that receive FDI will become less financially constrained than those that do not receive FDI. Given its very favorable investment climate, Estonia has been very successful in attracting large inflows of FDI, as documented by the last row of Table 1. The sharp increase in FDI in 1998 is caused by acquisitions of two large Estonian banks by Swedish investors.

[9] The criteria are: (i) The firm's capital at the beginning and the end of the period should be positive; (ii) Investment should be non-negative; (iii) Investment should be smaller than end of period capital stock; (iv) Sales should be positive; (v) The average employment per year should be positive and equal or greater than 10 ; (vi) Labor cost in a given year should be positive ; (vii) Ownership shares should add up to 100.

[10] A detailed account of the implications of applying the criteria and for the construction of the sample can be found in Hobdari (2003).

[11] A detailed description of the sample composition by ownership and size can be found in Hobdari (2003).

[12] It would be interesting to compare this ownership distribution with the economy-wide one prevailing in Estonia in 1995. Unfortunately, this is not possible because official data from statistical yearbooks do not provide detailed classification of ownership shares held by different owners as defined above. Furthermore, although the official data distinguish between state, foreign and private firms, it is not clear which definition is used to classify firms in a given group. For example, Estonia Statistical Yearbook (1995) states that, by the second half of 1995, 87% of enterprises in Estonia were private. It is highly likely that even enterprises with a small involvement of private capital are classified as private ones, leading to potential overstatement of the true degree of private ownership.

[13] In our empirical work in order to check the robustness of results, as well as for possible consequences of entry and exit of firms over time, we report estimates using both the balanced and unbalanced panels.

[14] Financial statements contain some information on sources of financing investment in fixed capital. This information, however, is missing for most of the firms in our sample. With the non-missing information a sub-sample of 862 firm observations over time is constructed. The summary statistics of the relevant variables for these observations are similar to those from the unbalanced and balanced panel.

[15] The data for loans include both short-term and long-term loans.

[16] In several cases the sum of respective shares from both tables belonging to a given ownership group does not sum up to 1. This means that other sources, except for internal funds and loans, have been used to finance investment. These sources are classified as private sources and might consist either of owner's own financing that does not go to increase owner's share in the company or of financing coming from other non-financial institutions.

[17] As shown in Table 1, the share of credit extended to the private sector to GDP, although increasing over time, has been low. This phenomenon, associated with high demand for funds at the beginning of transition, leads us to conjecture that fierce competition in the credit market has resulted in credit rationing for a subset of firms.

[18] Only the data used by Lizal and Svejnar (1998, 2002) cover a long enough time span that allows the authors to capture appropriate dynamics.

[19] A good summary of switching regression models, their applications and problems in their estimation can be found in Maddala (1986) and Maddala and Nelson (1994).

[20] Hu and Schiantarelli (1998) estimate a similar model with unknown sample separation for a sample of U.S. manufacturing firms. On the other hand, Nabi (1989) estimates an endogenous switching regression model with known sample separation for a sample of Pakistani firms using information on firm's access to formal or informal credit markets to separate the sample. Other approaches that employ the switching regression model strategy are studies of the effect of liquidity constraints on consumption and studies of wage determination in labor markets. Finally, a similar approach is adopted by Cleary (1999), who employs a two-step procedure. In the first step he uses discriminant analysis to partition the sample into financially constrained, partially

financially constrained and not financially constrained firms. In the second step, he estimates investment equations separately for each sub-sample. The index constructed to partition the sample is assumed to be a function of firm liquidity, leverage, profitability and growth.

[21] In this analysis the results are obtained using the EM algorithm available in STATA 8. It should be stressed that standard error estimates are only approximate and, in general, might be biased downwards. During estimation the iterative method to obtain bootstrapped standard errors is used. Further, because the likelihood function is not globally concave, the choice is between several local maxima. The selected maximum is the one that maximizes the likelihood function obtained from different starting values of the classification criteria. More detailed discussion of these issues is provided in Wedel and Kamakura (2000), pages 84-91.

[22] Studies that employ the neoclassical/accelerator model of investment demand include Jorgenson and Siebert (1968), Jorgenson (1971), Anderson and Kegels (1997), Lizal and Svejnar (1998, 2002), Budina et al. (2000) and Bratkowski et al. (2000).

[23] An example would be a banking crisis or economy wide productivity shocks, which affect similarly all firms in the economy.

[24] The original notion of soft budget constraints, as introduced by Kornai (1980), regarded the state as paternalistic. The state was unwilling to accept the social consequences of closing down loss-making firms and, instead, would intervene and bail them out unconditionally.

[25] Tax arrears are those taxes that should have been paid but are not. Examples of such taxes are corporate and social security taxes.

[26] This is probably also the case for Estonia because it enforced a tough bankruptcy already from the early stage of transition (Mygind, 2000).

[27] This measure has two further pitfalls. First, it might fail to capture firms with genuine soft budget constraint, which is defined as the situation under which firm's behavior is conditional to its own expectation and financing

institution commitment that some financing will be provided in the future. Second, it might classify as firms that experience soft budget constraints those firms that in fact do not. For example, young or newly established firms might be loss-making during the first years of their existence until they gain market share and establish relations with financial institutions. In the meantime, they might be receiving outside financing in response to their long-term growth potential. Both these problems generate biases in the real number of firms that experience soft budget constraints, with the former understating the real number of firms that experience soft budget constraints, while the latter overstating it. The true direction and degree of the bias however is unknown beforehand. However, the fact that most of the firms that are classified here as experiencing soft budget constraints are large and established firms and not young small firms with low earnings but with possible high future earning potential indicates that the second source of bias is not important in this case.

[28] We estimated different versions of investment equations by experimenting with the number of lags of all variables included in the specifications. Standard model selection criteria, such as individual coefficients' significance, the adjusted R^2, Akaike Information Criteria and Schwartz Information Criteria, are then used to discriminate among models. The results presented here are for the best performing model. In this model, the investment equation includes lagged sales, twice lagged sales, lagged cash flow, twice lagged cash flow, lagged liquid assets, twice lagged liquid assets, lagged asset sales, and twice lagged asset sales, all normalized with lagged capital stock, along with ownership, time and industry dummies as explanatory variables.

[29] In unreported regressions we estimated the model using a restricted version of the switching function, which included only financial variables. The findings based on these estimates are essentially unaltered from those reported in Tables 5 and 6. These unreported regressions are available from the authors upon request.

[30] As noted, the sample separation into potentially constrained and non-constrained firms is endogenous and not known beforehand. Yet, in order to carry out the estimation an initial guess is needed to partition the sample. For details of the procedure used to estimate the starting values that are used to undertake the maximum likelihood estimation see Hobdari (2003).

[31] These results were obtained for the pooled sample. When estimation is carried out on data from individual categories of firms the range of estimates the authors obtain is quite large. For example, in Lizal and Svejnar

(1998) the sum of coefficients on output ranges from 0.002 to 0.597, while the sum of coefficients on profit ranges from –1.241 to 0.025. In Lizal and Svejnar (2002) the same coefficients ranges from –0.003 to 0.572 for output and from –0.808 to 0.063 for profit.

[32] Kalmi (2002) in a field survey of firms under insider ownership in Estonia reports that in only 6% of his sample there are no restrictions on share trading. Furthermore, in 92% of the cases insiders are asked to offer their shares first to current shareholders. This suggests that the possibility to get a capital gain on individual shares is quite limited like it is the case for collective ownership.

[33] The critical values of χ^2 distribution at 5% significance level with 46 and 45 degrees of freedom are 62.29 and 61.66 respectively. The respective values of likelihood ratio tests are 209.12 for the unbalanced panel and 147.38 for the balanced panel.